# REMARKS

This is a simultaneous amendment with request for continued examination (RCE) filed under 37 C.F.R. 1.114 in response to the final Office Action dated March 2, 2010.

## I. RESTRICTION REQUIREMENT

The withdrawn claims 10 to 15 have been canceled. However applicants reserve the right to file a divisional application in a timely manner prior to termination in the proceedings of the above-identified U.S. Patent Application in order to prosecute claims for the subject matter of canceled claims 10 to 15.

## II. INFORMATION DISCLOSURE STATEMENTS

A prior art reference, namely GB 1,208,383, which was listed on the information disclosure statement filed on September 26, 2006 with a publication date of March 30, 1989, was crossed-out on the copy of the information disclosure statement returned with the Office Action mailed on August 10, 2009.

However the listed GB patent number was incorrect due to a typographical error. GB 1,208,383 is not relevant at all to the subject matter of the present application. It discloses improvements in paper making machines.

Paragraph 2 on page 2 of the final Office Action suggests that GB 2,208,383 was the intended reference, because a copy of this latter reference was provided instead of a copy of GB 1,208,383. That is correct and GB 2,208,383 is indeed relevant to the subject matter of the present application. Furthermore the publication date of GB 2,208,383 is the same as that listed on the information disclosure statement for GB 1,208,383.

Perhaps a copy of the information disclosure statement filed on September 26, 2006 listing GB 1,208,383 could be returned with the patent number for the GB reference corrected so that it appears as 2,208,383 and the returned copy shows that GB 2,208,383 has been considered during examination.

Otherwise please advise us regarding the manner in which this deficiency can be corrected so that GB 2,208,383 will be considered during examination and listed on the front cover of any patent issuing from the above-identified U.S. Patent Application.

## III. CLAIM OBJECTIONS

The claims were objected to because all claims depending on independent claim 17 were not grouped together in accordance with M.P.E.P. 608.01 (m). Instead claim 21 was separated from the group of claims that depended on claim 17 by independent method claim 20.

Accordingly independent claim 20 was canceled and its amended subject matter was included in a new independent method claim 22, which now follows dependent claim 21. The subject matter of the new independent claim 22 further limits the composition of the refractory material used in the claimed method to a material composed of $Al_2O_3$, $SiO_2$, $ZrO_2$ and another oxide that is either MgO or CrO. The original wording that defined the composition in canceled claim 20 was much broader in its scope.

Withdrawal of the objection to the grouping of the dependent claims is thus respectfully requested.

## IV. OBVIOUSNESS REJECTIONS OF AMENDED METHOD CLAIM 17 AND THE CLAIMS DEPENDENT ON IT

Claims 3 to 7 and 17 to 21 were rejected as obvious under 35 U.S.C. 103 (a) over Bradley, et al, in view of U.S. Patent 3,360,353 (Torok, et al), as evidenced by Triantaflyllidis, et al (called "Obviousness Rejection I" in the following).

Claims 2 to 8 and 17 to 21 were rejected as obvious under 35 U.S.C. 103 (a) over Bradley, et al, in view of U.S. Patent 3,360,353 (Torok, et al), and further in view of U.S. Patent 4,814,575 (Petitbon) as evidenced by U.S. Patent 3,929,498 (Hancock, et al) (called "Obviousness Rejection II" in the following).

Claim 9 was rejected as obvious under 35 U.S.C. 103 (a) over Bradley, et al, in view of U.S. Patent 3,360,353 (Torok, et al), as applied to claim 17, and further in view of U.S. Patent 4,415,672 (Brennan, et al) **or** alternatively as

obvious under 35 U.S.C. 103 (a) over Bradley, et al, in view of U.S. Patent 3,360,353 (Torok, et al), as applied to claim 17, and further in view of U.S. Patent 4,814,575 (Petitbon), and further in view of U.S. Patent 4,415,672 (Brennan, et al) (called "Obviousness Rejection III" in the following).

### A. The Claimed Invention of Amended Claim 17

The limitations in the amended claim 17 are now summarized in this subsection. The method of amended claim 17 includes the following new features:

a) the refractory material is limited to a material comprising $Al_2O_3$, $SiO_2$, $ZrO_2$ and MgO or CrO (the original claim used "and/or" wording which leads to a very broad scope);

b) in the first step a of the claimed method the surface is treated only with laser radiation (this excludes methods as disclosed in Bradley, et al, in which the surface is treated with laser radiation but also pre-heated or simultaneously heated by means of an oxyacetylene torch); and

c) the method includes a second step following treatment with the laser radiation in which the refractory material is tempered to relieve thermal stresses (this feature originally appeared in canceled claim 9).

### B. Obviousness Rejections I and II

The changes in amended claim 17 overcome the obviousness rejections I and II, because the amended claim 17 includes the features and limitations of canceled claim 9. Canceled claim 9 was not rejected on the grounds according to obviousness rejections I and II.

### C. Obviousness Rejection III

The method claimed in claim 17 is no longer obvious from Bradley, et al, Torok, et al, as evidenced by Triantafyllidis, et al, because of the new limitations included in it.

Bradley, et al, and Triantafyllidis, et al, are articles in an Engineering Publications without claims, which are not written to the standards of patent claims. This fact should be kept in mind when considering their disclosures.

However Bradley, et al, does describe a novel treatment of the surface of a refractory material by preheating the surface with a flame, especially the flame of an oxyacetylene torch, and then treating the surface with laser radiation from a $CO_2$ laser to close pores on the surface and increase resistance to chemical attack and corrosion at high temperatures (see Introduction, p. 204). However the sturdy of Bradley, et al, is limited to two different refractory material compositions. One of Bradley's refractory materials contains 60 wt. % $Al_2O_3$ and no $SiO_2$ , together with minor inorganic oxides, while the other contains 83.5 %

$Al_2O_3$, 9.0 wt. % of $SiO_2$ and 4.5 % $Cr_2O_3$, together with minor inorganic oxides. Bradley, et al, do not disclose treating refractory materials that have the same refractory material compositions as claimed in applicants' claim 17, which necessarily includes $ZrO_2$, which is not even present as a trace material in the refractory material of Bradley, et al.

Bradley, et al, is primarily interested in surface treatments for furnaces and incinerators (see first sentence of the introduction), whereas applicants are interested in refractory materials for glass manufacturing. Claim 17 is specifically limited to refractory materials that have compositions that are suitable to make Danner blowpipes or drawing dies, which come in contact with a glass melt during glass manufacture.

Torok, et al, describes a method for continuously drawing tubes, rods or the like, which are made of glass or other thermoplastic materials, by means of the Danner process. Torok, et al, does point out the disadvantages of the outgassing of the refractory material during contact with the melt, which causes blisters in the glass product and also non-uniform wear on a mandrel made of the refractory material, which is used in the Danner process. However Torok, et al, does not disclose the detailed chemical composition of the refractory material of the mandrel or the chemical processes that occur at the surface of the refractory material.

Triantafyllidis, et al, describes a treatment method for a surface of a refractory material simultaneously with two different types of laser radiation (continuous $CO_2$ and diode laser) to reduce corrosion and chemical degradation

due to porosity and inhomogeneities (see abstract, p 140) and also to eliminate crack formation due to treatment with laser radiation (see conclusion, p. 144). Triantafyllidis, et al, indicates that the purpose of the diode laser radiation is to pre-heat and post-heat the surface prior to and after application of the $CO_2$ laser radiation (page 142, right column) to relieve thermal stresses. This reference also states that crack formation is the main problem with this sort of laser radiation treatment in the abstract.

Triantafyllidis, et al, also tested a refractory material containing about 82 wt. % of alumina and 8.5 wt. % of silica, like Bradley, et al. However Triantafyllidis, et al, also does not disclose a method of treating a refractory material, which corresponds to the applicants' claimed composition, which necessarily includes zirconia as well as MgO or CrO.

Bradley, et al, teaches that the porosity of the surface of refractory materials has been successfully reduced by laser treatments with laser radiation, but that one problem that is encountered in such treatments is the production of cracks due to the relief of thermally induced stresses cause by the laser radiation itself (see the paragraph bridging pages 204 and 205 of Bradley, et al). Also see the first several sentences of the "conclusion" on page 212 of the article of Bradley, et al.

Bradley, et al, performs experimental tests and has results that show that the cracking of the surface due to the laser radiation treatment can be eliminated by preheating in a novel flame-assisted laser treatment in which the surface of the refractory material is preheated with an oxyacetylene torch and then treated

with laser radiation. Also there were dramatic improvements in the molten salt corrosion results when the surface of the refractory material was treated with their novel flame-assisted laser treatment.

However Bradley, et al, describe results that clearly show that without the preheating with the oxyacetylene torch cracking of the surface is still observed after treatment with the $CO_2$ laser, although the surface is significantly smoother and the porosity of the surface is reduced (see the subsection "*3.1 Surface treatment without preheating*" on page 209 of Bradley, et al, particularly the last sentence of the first paragraph and the second sentence of the second paragraph, of this subsection). In contrast, the surface treatment according to applicants' amended claim 17 is different than that of Bradley, et al, because the surface treatment with the laser radiation is first performed and then after that the treatment with the laser the refractory material is tempered.

Torok, et al, recognizes the problems due to corrosion of the surface of a mandrel made of an electrically insulating refractory material by contact of its surface with a glass melt, but does not disclose a solution to these problems by treatment of the surface of the refractory material with laser radiation. Torok, et al, instead provide the mandrel with electrodes so that the glass melt flowing over it can be heated by joule heating. Torok, et al, find that this method improves the process of forming a rod or tube by more accurate control of the viscosity of the glass during drawing.

Thus Torok, et al, teaches nothing regarding the methods of treating the surface of a refractory material to provide a smoother surface with reduced porosity and eliminating cracking.

Neither Bradley, et al, nor Triantafyllidis, et al, disclose a method of treating the surface of a refractory material that produces a smooth nonporous surface and eliminates cracking due to the treatment with the laser radiation in which the refractory material is first treated with laser radiation and then subsequently tempered.

According to page 9 of the Office Action the applicants' claimed method including the tempering step is obvious when the subject matter of Brennan, et al, is combined with the disclosures in the aforesaid prior art references. Applicants respectfully disagree.

Brennan, et al, discloses novel glass-ceramic compositions, which provide a glass ceramic with high strength and excellent resistance to oxidation. Brennan, et al, does not disclose methods of treating the glass ceramic materials **or** indeed any methods that include tempering the glass ceramic (refractory) materials.

Brennan, et al, does disclose methods of heat treating crystallizable glass bodies comprising uniformly heating the glass bodies in a furnace (column 7, lines 13 to 28). These methods include a program of heating at various temperatures as set forth in Table II in columns 7 and 8. However Brennan, et al, does not disclose or suggest a method including tempering their glass ceramic

products, which are produced by their heat treatment methods from the green glass bodies.

In the background section of Brennan, et al, at column 1, line 59, to column 2, line 2, Brennan, et al, do disclose that the art teaches several techniques for strengthening glass ceramic bodies including thermal tempering after the glass ceramic body has been formed. But Brennan, et al, solve the problem of producing glass ceramic bodies of improved high strength and resistance to oxidation by a different method, namely by judicious selection of the composition of the green glass body and **thus lead away from employing thermal tempering to strength a glass ceramic body**.

Furthermore the purposes of performing a tempering disclosed in column 1 of Brennan, et al, are to be distinguished from the tempering according to the applicants. Elimination of surface cracks after laser treatment of the surface of the refractory material to produce a closed vitrified surface layer is entirely different from improving the bending strength of a glass ceramic body.

Brennan, et al, do not disclose or suggest a method of increasing the resistance of the surface of a refractory material to a glass melt during glass manufacture and increasing its service life comprising treating the surface with only laser radiation and then tempering the refractory material.

Thus there is no motivation or suggestion in the art to add the step of tempering the refractory material after treating its surface with only the laser radiation, because Brennan, et al, does not disclose the problem that the applicants are trying to solve and does not disclose anything related to the

problems of treating the surface of refractory materials with laser radiation to withstand repeated contact with a molten glass melt.

With respect to the motivation or suggestion to combine the features of various prior art references to arrive at a claimed invention for the purposes of a rejection for obviousness under 35 U.S.C. § 103 (a), the Federal Circuit has said in *Alza Corporation v. Mylan Laboratories, Inc.*, (Fed. Cir., No. 06-1019, 9/6/06):

> "A suggestion, teaching, or motivation to combine the relevant prior art teachings *does not have to be found explicitly in the prior art*, as "the teaching, motivation, or suggestion may be implicit from the prior art as a whole, rather than expressly stated in the references.... The test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and the nature of the problem to be solved as a whole would have suggested to those of ordinary skill in the art." However, rejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be *some* articulated reasoning with *some* rational underpinning to support the legal conclusion of obviousness. This requirement is as much rooted in the Administrative Procedure Act [for our review of Board determinations], which ensures due process and non-arbitrary decision making, as it is in § 103.
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> 441 F.3d at 987-88 (quoting *In re Kotzab*, 217 F.3d 1365, 1370 (Fed. Cir. 2000)) (citations omitted) (emphases added)). There is flexibility in our obviousness jurisprudence because a motivation may be found *implicitly* in the prior art. We do not have a rigid test that requires an actual teaching to combine before concluding that one of ordinary skill in the art would know to combine references. This approach, moreover, does not exist merely in theory but in practice, as well.
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> Our recent decisions in *Kahn* and in [*Cross Med. Prods., Inc., v. Medtronic Sofamor Danek, Inc.*, 424 F.3d 1293 (Fed. Cir. 2005)] amply illustrate the current state of this court's views."

In other words, the Federal Circuit would agree that the above-cited prior art references would <u>not</u> need to <u>explicitly</u> provide a written <u>suggestion</u> to include

tempering in the methods for sealing the surface of a refractory material so that the pores are closed and there are no thermally induced cracks (which of course they do not). But in view of the great number of methods employed in the glass/glass ceramics arts in which there is a tempering step they would probably require something more in the reference that suggests including the tempering step in methods to seal the surface of a refractory material with laser radiation than the statement in the background section of Brennan, et al. This sort of statement relates to bulk strength of the material, not to surface properties of the material.

Instead there should be "*some* articulated reasoning with *some* rational underpinning" for expecting that it would be advantageous to include tempering as disclosed by Brennan, et al, in a method of treating the surface of the refractory material with laser radiation to improve its service life when it is used in glass manufacture.

Furthermore the results of applying the methods of Bradley, et al, and Triantafyllidis, et al, to the applicants' refractory material are <u>not</u> entirely <u>predictable</u>, because the refractory materials of the prior art do not have the same composition as the applicants' materials, according to amended claim 17, which contain <u>zirconia</u> as well as alumina and silica. The composition of a material is crucial for determining its thermal properties, such as its thermal expansion coefficient and spalling properties.

Although obviousness does not require absolute predictability, at least some degree of predictability is required. See M.P.E.P. 2143.03 and ***In re***

***Rinehart***, 189 U.S.P.Q. 143(C.C.P.A. 1976). The chemical arts, in contrast to the mechanical arts, are generally somewhat unpredictable despite the advances of recent years. Thus there is no reason to expect a priori that the thermal properties of the applicants' refractory materials would be the same or even in some cases similar to those of the refractory materials of Bradley, et al, which do not contain any zirconia. Thus there is no reason to expect that tempering should be employed to improve a method in which the surface of the applicants' refractory materials is treated only with laser radiation to form a closed vitreous layer.

Because the features and limitations of claim 9 have been included in claim 17 by the above changes, withdrawal of the rejection of amended claims 3 to 7, 17 to 19, and 22 as obvious under 35 U.S.C. 103 (a) over Bradley, et al, in view of U.S. Patent 3,360,353 (Torok, et al), as evidenced by Triantaflyllidis, et al, is respectfully requested.

Because the features and limitations of claim 9 have been included in claim 17 by the above changes, withdrawal of the rejection of amended claims 3 to 8, 17 to 19, and 22 as obvious under 35 U.S.C. 103 (a) over Bradley, et al, as applied to claim 17, in view of U.S. Patent 3,360,353 (Torok, et al), and further in view of U.S. Patent 4,814,575 (Petitbon) as evidenced by U.S. Patent 3,929,498 (Hancock, et al) is respectfully requested.

For the aforesaid reasons and because of the changes in claim 17, it is respectfully submitted that amended claims 2 to 8, 17 to 19, and 21 to 22 should

not be rejected as obvious under 35 U.S.C. 103 (a) over Bradley, et al, in view of U.S. Patent 3,360,353 (Torok, et al), and further in view of U.S. Patent 4,415,672 (Brennan, et al), with or without U.S. Patent 4,814,575 (Petitbon) and with or without any evidence provided by Triantaflyllidis, et al, and/or Hancock, et al.

## V. NEW METHOD CLAIM 22

Independent method claim 20 was rejected as obvious under 35 U.S.C. 103 (a) over Bradley, et al, in view of U.S. Patent 3,360,353 (Torok, et al), as evidenced by Triantaflyllidis, et al.

Independent method claim 20 was also rejected as obvious under 35 U.S.C. 103 (a) over Bradley, et al, in view of U.S. Patent 3,360,353 (Torok, et al), and further in view of U.S. Patent 4,814,575 (Petitbon) as evidenced by U.S. Patent 3,929,498 (Hancock, et al).

New claim 22 replaces canceled claim 20. New claim 22 includes the additional limitation that the composition of the refractory material is limited to comprising $Al_2O_3$, $SiO_2$, $ZrO_2$ and MgO or CrO.

Claim 22 covers a method in which the surface of the refractory material has been treated **only** with laser radiation.

Torok, et al, does describe a method in which a glass melt is processed to form a tube or a rod by bringing the glass melt into contact with a surface of a mandrel composed of refractory material. Torok, et al, does disclose the problem of corrosion and/or reaction of the glass melt with the refractory material, which

causes deterioration in the quality of the product of the process and shortens the service life of the mandrel.

However Torok, et al, provides an entirely different solution to the problems due to the aggressive interaction of the glass melt with the surface of the refractory material than Bradley, et al, and Triantaflyllidis, et al. Torok, et al, teaches nothing regarding improvements of methods of treating the surface of a refractory material with laser radiation to improve the service life of the material when it is repeatedly brought in contact with a glass melt.

Bradley, et al, and Triantaflyllidis, et al, teach methods of improving the treatment of the surface of a refractory material with laser radiation to improve the surface properties to extend its service life and prevent corrosion of the surface, which include both treating the surface with laser radiation and also preheating the surface so that cracks formed by the laser radiation during the treatment are eliminated or prevented and the pores are closed. In contrast, the refractory material used in the method claimed in claim 22 is only treated with laser radiation.

In addition, Bradley, et al, and Triantaflyllidis, et al, teach that the refractory material is used in furnaces and incinerators and do not suggest that their methods would improve the surface of a refractory material for components that handle molten glass at the very high temperatures of the glass melt.

One skilled in the glass art, when confronted with these three prior art references, would not modify the methods of Torok, et al, for handling a glass melt according to the teachings of Bradley, et al, and Triantaflyllidis, et al,

because Torok, et al, teaches that the problems are solved by a different method, namely passing a current through the glass melt on the mandrel to better control its viscosity during drawing to form a glass tube.

Because of the additional features and limitations that have been included in claim 22 in comparison to canceled claim 20, it is respectfully submitted that new method claim 22 should not be rejected as obvious under 35 U.S.C. 103 (a) over Bradley, et al, in view of U.S. Patent 3,360,353 (Torok, et al), as evidenced by Triantaflyllidis, et al.

Since the amended claim 22 does **not** include any of the limitations of claim 8 regarding treating the surface of the refractory material with a powder or solution before or during treatment with laser radiation, then the teachings of Hancock and/or Petitbon are not relevant for claim 22. Hence the above argumentation should be equally effective to overcome the second obviousness rejection listed above in this section IV.

Because of the additional features and limitations that have been included in claim 22 by the above changes, withdrawal of the rejection of amended method claim 22 as obvious under 35 U.S.C. 103 (a) over Bradley, et al, in view of U.S. Patent 3,360,353 (Torok, et al), as applied to claim 17, and further in view of U.S. Patent 4,814,575 (Petitbon) as evidenced by U.S. Patent 3,929,498 (Hancock, et al), is respectfully requested.

In addition, the new claim 22 should not be rejected as obvious under 35 U.S.C. 103 (a) over Bradley, et al, in view of U.S. Patent 3,360,353 (Torok, et al),

as evidenced by Triantaflyllidis, et al, with or without any of the other prior art references mentioned in these REMARKS.

Should the Examiner require or consider it advisable that the specification, claims and/or drawing be further amended or corrected in formal respects to put this case in condition for final allowance, then it is requested that such amendments or corrections be carried out by Examiner's Amendment and the case passed to issue. Alternatively, should the Examiner feel that a personal discussion might be helpful in advancing the case to allowance, he or she is invited to telephone the undersigned at 1-631-549-4700.

In view of the foregoing, favorable allowance is respectfully solicited.

Respectfully submitted,

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